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Executive Development

Pre-disaster planning for post-disaster recovery: Can a long term recovery plan help in disaster preparedness?

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed:_____

Abstract

The problem was the Aurora Fire Department had not determined the need for a pre-disaster recovery plan in the event of a disaster. The purpose was to identify the benefits of a pre-disaster recovery plan. This was a descriptive research project to answer what impact have previous disasters had; what types of threats face Aurora in the future and the impact; would a pre-disaster recovery plan aid in long-term recovery and what types of pre-disaster recovery plans do other municipalities utilize? The results were that many communities do not have a pre-disaster recovery plan in place. The major recommendation was develop a pre-disaster recovery plan meeting short-term recovery needs while balancing long-term objectives for creating a more resilient community.

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Introduction

The Office of Emergency Management (OEM) is a function of the Aurora Fire Department. In the past, OEM has been focused on response. Recovery planning begins after the disaster has impacted the community. With the events of recent years around the country, a recovery plan identified as part of the planning process could have improved the recovery process for affected communities. The problem is the Aurora Fire Department has not determined the need for a pre-disaster recovery plan in the event of a disaster. It will be demonstrated that this could result in increased economic impact and social disruption following a catastrophic event. In the absence of a pre-disaster recovery plan, recovery efforts are delayed and confusion and chaos become the standard during the recovery process.

The purpose of this research is to identify the benefits that a pre-disaster recovery plan will have on the long term recovery efforts for the City of Aurora. This is a descriptive research project to answer the following questions:

1. What impact have previous disasters had on our economy, infrastructure and the environment?
2. What types of threats face our community in the future?
3. What impact will these threats have on our community?
4. How would a pre-disaster recovery plan aid in long term disaster recovery?
5. What types of pre-disaster recovery plans do other municipalities utilize?

This project will include a historical review of past disasters that have affected the City of Aurora and the impact they had. These disasters will be compared to the potential

future threats facing the citizens of Aurora. A literature review pertaining to post disaster recovery efforts will be conducted, identifying methodologies that were successful and those that may have needed improvement. A questionnaire of other municipality's current planning process will help to identify if any pre-disaster recovery plans currently exist as well as other plans that may be used during the recovery process. An analysis of the current planning and recovery process will be used to describe any impact that a pre-disaster recovery plan will have on the ability to recover from a disaster.

Background and Significance

The City of Aurora, CO is the third largest city in Colorado with over 300,000 (U.S. Census, 2000) people and covers 144 square miles (Aurora Fire Department [AFD], 2006). Aurora continues to grow in size and population, with a population increase of over 68,000 people in the last ten years (AFD, 2006). Due to its close proximity to Denver, accessibility to the metropolitan area, as well as the opportunity to live in a community that has the amenities of a big city without the big city feeling, Aurora has become an attractive place to live.

Currently, the Aurora Fire Department (AFD) consists of 15 fire stations with a staff of 288 firefighters and 20 administrative personnel, which includes payroll, investigations, fire safety and emergency management among other functions (AFD, 2006). The Office of Emergency Management consists of two personnel and is responsible for all comprehensive disaster planning, training and exercises. The City of Aurora maintains a comprehensive Emergency Operations Plan (EOP) and is in the process of developing a Continuity of Operations Plan (COOP). A mitigation plan has been developed by the Denver Regional Council of Governments (DRCOG) and has been

adopted by Aurora, as well as several other jurisdictions, as the comprehensive mitigation plan.

Aurora faces many technological hazards as it is a major transportation hub with two interstates, a major railway line, and is close to Denver International Airport. Aurora is home to several large federal defense contractors including Lockheed Martin and Raytheon. Buckley Air Force Base, which houses part of the North American Aerospace Defense Command (NORAD) Early Warning Defense System, is also located in Aurora. Aurora recently became home to the University of Colorado Health Sciences Center, which when completed will be the largest medical research facility west of the Mississippi River. This facility houses a bio level III safety lab as well as numerous chemical, radiological and specialty research areas.

Geographically, the City of Aurora is located in an area that is subject to a variety of natural disasters. The most likely natural hazards are flash flooding, severe winter weather and tornadoes. Colorado disaster history shows that there have been fifteen major disaster declarations and four emergency declarations. Aurora received three of the four emergency declarations. All of the major disaster declarations were hazards that are likely to occur in Aurora, with 80% of the disasters involving flooding, Aurora's number one natural hazard threat (Federal Emergency Management Agency [FEMA], 2007). The most recent emergency declaration was December 2006 when Colorado experienced severe winter weather to include consecutive blizzards. The cost of this storm to the City of Aurora was approximately 1.5 million dollars, of which just over 500,000 was received in reimbursement costs from FEMA. This was the second blizzard in three years that Aurora received an emergency declaration for.

While the blizzards do not require a significant recovery process, recovery efforts were still needed. During the emergency declared blizzard in 2003 there were several businesses and homes that received structural damage requiring assistance in their recovery process (City of Aurora, 2003). The blizzard of 2006 had no structural damage, but due to the consecutive storms, the time needed to remove snow was prolonged, causing congestion of critical lifelines in and out of Aurora (City of Aurora, 2007).

Aurora also assisted in the Hurricane Katrina evacuation from Louisiana, named Operation Safe Haven. One week following the hurricane, Aurora and the State of Colorado prepared to receive 1000 evacuees and provide temporary shelter. It is important to realize that the normal procedure for declaring a disaster was reversed during this event. A disaster typically begins locally, once the resources are exceeded then regional, state and federal resources are included. The incident remains local with assistance from these agencies. During Operation Safe Haven the incident started at the Federal Level. A call was then made to the Governors around the country. Governor Bill Owens agreed to receive 1000 evacuees. From there the local jurisdiction was brought in. Operation Safe Haven was a State run operation with the majority of support being received from the local level (City of Aurora, 2005).

Two planes brought approximately 300 evacuees to Aurora. An additional 2000 individuals self evacuated to the Aurora evacuation site. Individuals registered at the reception center which consisted of an initial medical screening, dorm assignment, change of clothing and issuance of an identification card. Many of the evacuees came with nothing and these basic items were essential for them to begin returning their lives to normal. Once registered, individuals were transported to the dorm where the Salvation Army provided hot food and individuals were able to shower and change. One of the

major issues was medical care. Many individuals came without medication and had been without their medication for over a week. The medical branch coordinated an on site urgent care clinic and pharmacy to meet these needs.

While this was not a disaster for Aurora, the recovery process was an integral piece for the evacuees. Aurora provided temporary shelter, food, medical care and coordinated the long term recovery needs for the individuals brought to Aurora. This event highlighted the need for a pre-disaster recovery plan. The potential for the citizens of Aurora to have the same recovery needs is high. Many issues were not anticipated in advance due to the lack of a recovery plan. While the needs of these individuals were met, a template or guide through the recovery process would have made the process smoother.

Overall the operation was a success. Twenty two different agencies were able to work together in a multi-jurisdictional approach to accomplish the tasks outlined in Emergency Support Function (ESF) #6, Mass Care, of the National Response Plan (City of Aurora, 2005).

The future holds the potential for even greater threat with the increase of terrorism related incidents. With Aurora being located in a major metropolitan area with the highest number of defense contractors located within the city limits, this threat is real. The impact of a disaster of this type would cause significant disruption to the economic stability and social order of the community. The lack of a pre-disaster recovery plan will have a significant impact on the ability to recover in a effective and efficient manner.

This research project relates to the key concepts of “develop and integrate change management and leadership techniques necessary in complex organizations” (National Fire Academy [NFA], 2006, p. SM 0-3) as identified in the Executive Development

course at the National Fire Academy (NFA). This course stressed the importance of building high-performance teams and approaches to leading and managing change, (both of which are critical components to development of a pre-disaster recovery plan.

This research project also relates to two of the United States Fire Administration (USFA) operational objectives: "to respond appropriately in a timely manner to emerging issues" and "to promote within communities a comprehensive, multi-hazard risk reduction plan led by the fire service organization" (NFA, 2002, p.II-2). The literature review will demonstrate that the need for pre-disaster recovery planning is fast becoming a need throughout the nation as well as in the City of Aurora. Additionally, interviews with key community leaders will reveal the need for the OEM to work with the community to develop a plan in advance that facilitates a more efficient recovery.

Literature Review

The basic fundamentals of emergency management consist of four phases: preparedness, mitigation, response and recovery. Each of these phases has distinct actions that need to happen (Haddow & Bullock, 2003). What is often overlooked is that each of these phases is not independent to the other. They are inter-reliant and happen concurrently (Waugh 2000). Decisions that are made during the preparedness phase will have an impact on the response phase. Likewise, decisions made during the response phase will have an impact on the recovery phase (Neal 1997). Once the recovery phase has begun, mitigation is a parallel part of the recovery process to encourage disaster resistant reconstruction (National Fire Protection Association [NFPA], 2007). One of the shortcomings for many municipalities is that the recovery process is often not thought of until after the disaster strikes, and typically not until the response phase is almost complete (Emergency Management Institute [EMI], 2004).

One of the thirty seven target capabilities as identified by the Department of Homeland Security (DHS) is the recover mission area. There are three objectives identified in the recover mission area: assist the public, restore the environment and restore infrastructure. Within these three areas are several sub-topics that each community is expected to accomplish after a disaster (Department of Homeland Security [DHS], 2005).

The recovery phase can have several components to achieve these three objectives. Schwab, Topping, Endie, Deyle & Smith (1998) identify four overlapping recovery periods. The first is the emergency period or the latter part of the response phase where the community is first realizing that they have encountered a disaster and beginning self recovery efforts. The second is the restoration period. During this time essential services are repaired and restored to facilitate the rest of the recovery process. The third period is the replacement/reconstruction period. This is the time when the economic vitality of the community is beginning to be restored, often times to a new normal. The last is the development reconstruction period. Future growth is planned and typically becomes part of a community's comprehensive plan and capital improvements plan. This is the time period where mitigation efforts are incorporated to ensure a more disaster resistant community.

In addition to the overlapping periods mentioned above, there are two basic phases of recovery, short term and long term. During these recovery phases there are several issues that should be addressed. Some of the short term issues include maintenance of essential services, temporary shelters, debris removal, food and water, building assessment and health and welfare for the community. Long term issues include economic recovery, social order, disaster relief and reconstruction (Neal, Schwab et al.,

& Waugh, 1997, 1998, 2000). Often times conflict will develop when setting priorities for short term and long term recovery actions. Immediate actions needed to meet the needs of the affected citizens may not meet the needs of long term sustainability (Petterson, 1999).

Whether a community is using one of the models above or attempting to begin recovery as a single event, the community will be formulating what they believe the recovery process should look like as it affects them (Neal 1997). As soon as the disaster hits, each individual will be creating a recovery picture as it relates to them. Many will need financial assistance, some will need immediate shelter, and several may require mental health support. Emergency managers should anticipate what the community reaction will be and implement recovery processes as appropriate. Those communities that are proactive in this process will understand the community needs, recovery priorities and provide a more expeditious recovery process (Schwab et al, 1998). Because of the differing opinions of what the recovery process should look like, conflicts over priorities may emerge (Natural Hazards Center, 2005).

Recovery planning, therefore, should be a deliberate process that incorporates community planners, all levels of government and the community itself. NFPA 1600 (2007) requires municipalities to have a recovery plan and that it should entail short and long term priorities for restoring essential services and infrastructure. However, it does not state when this planning process should take place. It does comment that a “specific plan might be impossible in advance” (p. 13) but that a general strategy could be developed encompassing the major components of a long term recovery plan. The Natural Hazards Center (2005) out of Boulder, Colorado states that recovery is “a set of loosely related activities that occur before, during and after a disastrous event” (p. 2-1).

The Federal Emergency Management Agency (2004) states “effective recovery depends on the productive use of the existing organizational capabilities…and the timely employment of the available experts in the community” (p. SM 4-8). While developing this strategy, a municipality should look at their comprehensive plan, strategic plan, emergency operations plan and capital improvements plan, and incorporate complementary concepts and ideas into this strategy (Schwab et al., 1998). This comprehensive planning initiated ahead of time allows for the holistic disaster recovery approach to be successful (Natural Hazards Center, 2005). The overall goal of the recovery plan is to ensure that the citizens are safe, that economic vitality is restored (NFPA, 2007) and rebuilding a more disaster resilient community (Schwab et al., 1998).

When developing the recovery plan, attention should be given to lines of authority, intergovernmental coordination and non-governmental integration. Decision making amongst these different organizations along with their unique organizational culture will affect recovery efforts (Waugh, 2000). The initial recovery period will be confusing and chaotic, similar to the initial response period. Decisions will be made quickly and influence the direction of the long term recovery process. A recovery plan that identifies key recovery objectives and priorities facilitates decision making and allows for a more efficient recovery process (EMI, 2004). The planning process brings key players together in advance, saving time during the recovery process with pre-identified roles and responsibilities. Another consideration is also understanding disaster legislation from all levels of government and what the local official’s role is in dealing with the different levels of government (Schwab et al., 1998).

Most communities experience major disasters infrequently. Therefore, local officials are have little experience in responding to and recovering from a disaster and are

not accustomed to what their role is. Political pressures will become paramount with demands for economic and development improvements. These political pressures will be competing for the same monies that become available after a disaster. This further emphasizes how important it is for local officials to understand their role and plan in advance. This pre-planning will directly affect the overall response and recovery efforts (Petterson, 1999). To facilitate this, a review of existing policies of procedures as they relate to the recovery process should happen consistently to ensure that they are adequate for the community to recover from a disaster. In addition, local officials should review disasters that happened to other communities and what lessons learned can be incorporated into their planning process (Rubin, 1985).

Petterson (1999) discusses in a working paper for the Public Entity Risk Institute that it is uncommon for communities to plan in advance for recovery, utilizing scenarios that have the potential to affect their community. This forethought would allow communities to identify steps ahead of time to allow restoration of critical infrastructure and other key lifelines to happen predictably instead of haphazardly. She also states that this requires an organization wide approach with support for the key leaders in the community. This preplanning also allows the community to build stronger than before by incorporating stronger building codes and land-use regulations.

Communities experience some similar fallacies in their planning process. The primary focus of many plans is response. These plans are often not exercised after they are written. And key leaders are not aware of their roles within the plan (Petterson, 1999).

Colorado disaster history shows that there have been fifteen major disaster declarations and four emergency declarations. Aurora received three of the four emergency declarations. All of the major disaster declarations were hazards that are

likely to occur in Aurora, with 80% of the disasters involving flooding, Aurora's number one natural hazard threat (FEMA, 2007).

July 1997 produced one of the worst floods in Fort Collins, Colorado history. Intense rainfall over a three day period produced over ten inches of rain in three separate counties. For a period of time there were 172 people missing. All were found and 5 deaths were attributed to the flood (Doesken & McKee, 1997).

Due to the magnitude of the area involved, the disaster was initially divided into three separate incidents by the fire department to facilitate a coordinated response of the personnel involved. Over 500 rescues were made. One train derailed which contained a tank car carrying Chlorine, a deadly gas. Three mobile home fires were extinguished and there was one strip mall explosion. Power lines were down and many firefighters recall noticing an electrical current in the flood waters as they attempted to make rescues (Wold, 1999).

Damage around the Ft. Collins area was significant. 200 homes were destroyed and 1500 homes were damaged. Mobile homes were on fire and several floated downstream. The library located on the Colorado State University (CSU) campus suffered a severe impact, destroying approximately one million books. The campus also had 25 buildings that received significant damage (Wold, 1999).

The overall magnitude of this event demonstrates how quickly a community can be overrun by a disaster. Through cooperation with all agencies involved utilizing many of the technologies available, this incident was controlled and maintained keeping casualties and damages to as little as possible. The community has recovered as well, creating a better Emergency Management Office and focusing on recovery and mitigation for the future. They have developed tools for a similar disaster, which has become a

model in the emergency management community for others to follow. Many improvements have been made throughout the community to help prevent such traumatic outcomes in the future if a similar event were to occur (“Flash flood,” n.d.).

Governor Roy Romer declared a state disaster on July 30, 1997 and President Bill Clinton declared a federal disaster area on August 1, 1997. The quick reaction to make these declarations allowed the citizens in three counties to receive needed assistance immediately.

In the immediate few days following the flood, the extent of the damage was realized. Many citizens returned to their homes to find nothing left to salvage. One community was so devastated that it remains an open space park today. Hundreds of citizens were displaced and left homeless (“Flash flood,” n.d.).

Due to the amount of debris blocking the flow of water through the city, one major concern was additional flooding that afternoon. The weather forecast predicted more rain for the early afternoon. Immediate efforts were focused on clearing out the debris. Colorado Urban Search and Rescue was contacted to conduct a thorough search for more rescues or recoveries. No further bodies were discovered and the loss of life stayed at five (Ray & Weaver, 2000).

The American Red Cross began providing assistance immediately. Through their large network of volunteers, temporary housing was provided for 249 families. Food, clothing and medical assistance was made available for those in need (Wold, 1999).

The City of Fort Collins with assistance from the State of Colorado set up a Disaster Recovery Center to provide information and aid to the flood victims. Victims were assisted in filing insurance claims and applying for and receiving federal grant money to help them rebuild (Richardson, 1997).

Much of the town was also in need of care. Several cars were overturned, streets were blocked by debris, and mobile homes were slammed together, sometimes torn in half. Residents had to delve through piles of debris to find anything that could be salvaged. The Larimer County landfill waived fees for residents dropping off flood debris. While a grand gesture by Larimer County, this caused a 25% increase in the anticipated amount of landfill. This has led to Larimer County looking to purchase more land for a new landfill well ahead of the schedule in the master plan (Wold, 1999).

Colorado State University received the majority of the losses, estimated in excess of $100 million dollars, with the loss of several books, reports and papers that were irreplaceable. CSU implemented several mitigation measures to protect itself from a 100 year flood and more strict measures in the most vulnerable areas to protect from a 500 year flood. CSU was able to open on schedule for the fall semester with enough books for students to utilize, a major accomplishment for the University (Wold, 1999).

Even though Fort Collins had an excellent storm water pan, allowing the city a level 6 flood risk rating, the flood of 1997 more than doubled the planning for a 500 year flood. Mitigation efforts were reevaluated, focusing on the drainage systems and areas that were the most vulnerable during the flood. Improvements were made to the most vulnerable areas, still using the 500 year flood criteria (Ray & Weaver, 2000).

One year after the flood, much of the City had been restored. However, there were still recovery operations underway. New mitigation projects were being evaluated and put in place to provide the best protection possible for an event of such magnitude in the future.

In comparison, the tornado of 2007 in Holly, Colorado was one of the most devastating tornadoes to affect a Colorado community. The Town of Holly has a

population of 1100. It is located in Prowers County in the Southeast portion of the State. On March 28, 2007, an F3 tornado, as classified by the National Weather Service, passed through the Town of Holly causing a path of destruction two miles long. Forty eight structures were destroyed or severely damaged, this is one third of all the homes in Holly. 114 additional homes received minor damage. Two fatalities are the result of this tornado as well as eight major injuries requiring hospitalization (Colorado Department of Local Affairs [DOLA], 2007). This is the first tornado related fatality since 1960 ("Tornado," 2007). Critical infrastructure was severely impacted with disruption of the water system, electrical power and gas services (DOLA, 2007).

During the initial recovery efforts the primary objectives included life safety, restoration of infrastructure, environmental impact and mass care for the displaced population. Slevin (2007) reported that short term recovery issues related to life safety included searching the damaged area for additional casualties and ensuring medical care was available for all residents. Long term considerations include the mental health needs. This community was in the process of recovering from back to back blizzards in late December, early January. Many lost livestock and incurred a substantial financial impact. The reality of this tornado has added to the stress that this community has already endured. The Colorado Division of Mental Health created a mental health network to bring in professionals to meet the immediate and long term mental health related needs for the Town of Holly.

It took nearly two days to restore electricity to those structures that were able to be reoccupied. To facilitate this process application fees were waived for electrical inspections (DOLA, 2007). Portable generators were set up to provide electrical service to maintain the town's critical services such as the water system and power to the local

nursing home (“Recovery continues,” 2007). Streets were lined with trees and downed power lines. Five thousand cubic yards of debris had already been removed three days after the tornado.

Those that were not able to return to their homes were placed in a shelter at the local school. Through cooperation with the American Red Cross, Salvation Army, local Wal-Mart, Home Depot, and King Soopers, the immediate mass care needs were taken care of such as bringing in bottled water, food and other basic necessities. Long term recovery procedures included bringing in 50 FEMA trailers to provide temporary housing for many of the Town’s residents. Another long term recovery issue was managing the donations. Three months after the tornado there was still a need for construction supplies but they were overwhelmed with basic necessity items. Storage space was soon overwhelmed and a press release was issued to advise concerned citizens to please only donate cash or construction related items (Mestas, 2007).

The State declared a state of emergency in the immediate days that followed the tornado. However, with all of the recorded damage, Holly did not receive a presidential disaster declaration. The impact from this is that no federal reimbursement for the response and recovery efforts was available, to include public assistance and individual assistance. The Governor also requested Small Business Administration assistance which was approved on April 5, 2007 (DOLA, 2007). This allowed some assistance for the area small business to rebuild and move toward economic recovery.

The literature review in relation to pre-disaster recovery planning identified a number of ideas that will help identify whether this type of plan would be useful for the City of Aurora. The two case studies identify differing recovery efforts affecting communities in Colorado. Each community experienced a disaster that Aurora is also

subject to. Neither community had a pre-disaster recovery plan in place prior to the event. While both communities recovered, the possibility exists that with pre-planning, a more efficient and effective recovery process could have taken place. The literature also identified some advantages to having a pre-disaster recovery plan in place. Many of the same recovery goals found throughout the literature emphasize the importance of understanding community's recovery priorities in advance.

Procedures

A descriptive research method was utilized to answer the research questions posed by this author. To answer what impact have previous disasters had on our economy, infrastructure and the environment, a detailed analysis of previous disasters that occurred in Colorado and the impact that was received. This included reviewing after action reports from various disasters such as the Fort Collins Flood of 1997, blizzard of 2006 and the Holly tornado of 2007, all significant natural hazards that could impact the City of Aurora. Additionally, a review of those disasters where the City of Aurora received a presidential declaration and the overall impact caused to the City was conducted. Additionally, personal experiences had by this researcher during the Hurricane Katrina evacuation of the affected population to Colorado was included in the research.

Data was collected from the NOAA's website to determine significant weather related events that have affected the City of Aurora. A review of tornado and flooding events over the last ten years was the focus of this data collection.

A review of the State of Colorado's hazard mitigation plan answered the question what types of threats face our community in the future. The above review also helped to answer the question of what impact these threats will have on our community.

An extensive literature review identified if a pre-disaster recovery plan would aid in long term disaster recovery. This included reviewing previous research, educational texts, and lessons learned from previous disasters. In particular, a comprehensive review of information documented prior to 2001 as compared to after 2001, of which many philosophies have changed due to the major events following 2001. The researcher also attended a conference where the focus of one session was pre-disaster recovery planning.

The final step involved the researcher distributing a questionnaire to identify what types of plans other municipalities have or don't have. A copy of this questionnaire is located in Appendix A. To accomplish this, the researcher wanted information from other municipalities in the State of Colorado and FEMA region VIII, where similar threats are present. The purpose of this questionnaire was to identify what type of plans various communities had in place, if a disaster had been experienced by the respondent community, what were the major challenges during recovery and what were the major issues during the recovery process. The questionnaire was created on www.surveymonkey.com and was distributed through electronic medium. The Operations Officer for the State of Colorado Division of Emergency Management was contacted by telephone and asked to distribute the questionnaire via email to the County emergency managers throughout Colorado. The president of the International Association of Emergency Managers (IAEM) for FEMA Region VIII was contacted by telephone and asked to distribute the questionnaire via email to the registered IAEM members throughout this region. FEMA Region VIII consists of Colorado, Utah, North Dakota, South Dakota and Wyoming. FEMA Region VIII and was chosen due to the similarity in hazards experienced throughout the region. Members from Colorado were excluded to avoid duplication from the distribution by the Operations Officer.

Limitations

The City of Aurora as well as the State of Colorado is subject to a variety of natural hazards. However, very few large scale events have been experienced. The data obtained from local disasters as compared to more disaster prone communities is not meant to imply that Aurora is subject to the same level of disaster, rather to generalize the impact that a pre-disaster recovery plan can have for a community.

Definition of Terms

Continuity of operations plan-A governments plan to ensure survivability of the organization when confronted with a disaster.

Emergency operations plan-Comprehensive plan that details the activities involved in the four phases of emergency management; preparedness, mitigation, response and recovery.

Individual assistance-After a presidential disaster declaration is made, financial assistance becomes available to individuals for private residences, business and loss of personal property. (Waugh, 2000)

Mitigation-Any action taken to eliminate or reduce the degree of long-term risk to human life, property and the environment from natural and man-made hazards. Mitigation measures include, but are not limited to, building codes, disaster insurance, hazard information systems, land use management, hazard analysis, land acquisition, monitoring and inspection, public education, research, relocation, risk mapping, safety codes, statutes and ordinances, tax incentives and disincentives, and stockpiling of emergency supplies

Preparedness-Any activity taken in advance of an emergency that facilitates the implementation of a coordinated response in the event an emergency occurs. Preparedness measures include, but are not limited to, continuity of government, emergency notification and alert systems, emergency information materials, exercise of plans, mutual aid agreements, resource management, warning systems and training response personnel.

Public assistance-After a presidential disaster declaration is made, financial assistance becomes available to a local government for repair of infrastructure, repair of public buildings and debris removal (Waugh, 2000).

Recovery-The short-term activity to return vital life-support systems to minimum operating standards and long-term activity designed to return life to normal or improved levels, including some form of economic viability. Recovery measures include, but are not limited to, assisting the public by providing long term healthcare, recovery information and social services; restoring the environment through site cleanup, debris removal, site remediation and restoring natural resources; and restoring infrastructure by reconstituting government services, performing structural damage assessment and mitigation, rebuilding property, restoring lifelines and restoring economic institutions.

Response-Any action taken immediately before, during, or directly after an emergency occurs to save lives, minimize damage to property and the environment, and enhance the effectiveness of recovery. Response measures include, but are not limited to, on-site incident management, emergency operations center management, critical resource logistics distribution, volunteer management and donations, worker safety and health, public safety and security response, animal health emergency support, environmental health and vector control, explosive device response operations, firefighting operations and support, weapons of mass destruction (WMD)/hazardous materials response and

decontamination, citizen protection through evacuation or in-place sheltering, isolation and quarantine, search and rescue, emergency public information and warning, triage and pre-hospital treatment, medical surge, medical supplies management and distribution, mass prophylaxis, mass care including feeding, sheltering and related services, and fatality management.

Results

Research Question 1. What impact have previous disasters had on our economy, infrastructure and the environment?

Data collected from the NOAA website showed that in the past ten years Aurora has experienced two tornadoes that caused significant damage. The first tornado touched down in 1998 causing 100,000 dollars in damage at the Aurora Airpark. A hangar was destroyed as well as one vehicle and one single engine airplane. There were no reports of injuries.

The second tornado caused damage to a condominium complex that was under construction. Approximately six million dollars in damage was incurred from four condominium structures being destroyed. Additionally, there was one injury to a man that sought shelter in a construction trailer. The trailer flipped four times causing him to receive four broken ribs.

Additional data showed that six flooding events have impacted Aurora in the last ten years. There was no economic impact recorded. Critical infrastructure impact included several critical roadways that were shut down for several hours during each of these events. Roadway damage was also received; however, no financial cost for repair was listed.

Research Question 2. What types of threats face our community in the future?

The Denver Regional Council of Governments (DRCOG) Natural Hazard Mitigation Plan (2003) identifies the most significant hazards to affect the City of Aurora to be flooding, tornadoes, severe winter weather and drought. Aurora faces many technological hazards as it continues to be a major transportation hub with two interstates, a major railway line, and it's proximity to Denver International Airport. There is an increased terrorist threat with Aurora housing several large federal defense contractors including Lockheed Martin and Raytheon. Buckley Air Force Base, which houses part of the NORAD Early Warning Defense System, is also located in Aurora. Additionally, the University of Colorado Health Science Center has recently relocated to Aurora. This facility brings with it a significant biological, chemical and radiological hazard as well as a domestic terrorism hazard based on the types of research that may be conducted (AFD, 2006).

Research Question 3. What impact will these threats have on our community?

Two of the most significant threats are flooding and tornados. The literature review highlighted case studies from Fort Collins and Holly, Colorado. Fort Collins demonstrated that very quickly a slow moving thunderstorm can overwhelm a system. Recovery efforts remained for over one year, with the most significant long term recovery issues affecting infrastructure restoration and economic stabilization. While no major rivers run through Aurora, there are two major streams as well as two Class 1 dam's. Failure of a Class 1 dam would impose catastrophic damage to include fatalities to the area affected. Aurora Water's dam failure contingency plan also lists the creeks in Aurora as having the potential to cause significant damage and disruption to services (City of Aurora, 2006).

Tornados are another significant natural hazard that Aurora has experienced. The Colorado Hazard Mitigation Plan identifies the area East of Interstate 25 as being the most susceptible to tornado's. The recent Holly tornado demonstrates the intensity of tornadoes that can affect Colorado, including Aurora.

Research Question 4. How would a pre-disaster recovery plan aid in long term disaster recovery?

Holly, Colorado also demonstrated the need to plan in advance for recovery. When developing the recovery plan, attention should be given to lines of authority, intergovernmental coordination and non-governmental integration. The Mayor of Holly was injured in the tornado and hospitalized. This required the line of authority to move to the next person in the chain of command. Several private sector businesses provided assistance in the recovery process. Through cooperation with the American Red Cross, Salvation Army, local Wal-Mart, Home Depot, and King Soopers, the immediate mass care needs were taken care of such as bringing in bottled water, food and other basic necessities. FEMA also delivered 50 trailers to assist with the housing needs for the community (DOLA, 2007).

Research Question 5. What types of pre-disaster recovery plans do other municipalities utilize?

An external feedback instrument was distributed to emergency managers in Colorado and FEMA Region 8 in an attempt to identify if any pre-disaster recovery plans already existed, what other types of plans were in place, and what issues were encountered during recovery from a disaster. Forty one questionnaires were returned ranging in population size from 300 to 300 million.

In reviewing the different types of plans communities utilized, 97.6 percent have an emergency operations plan, 63.4 percent have a pre-disaster mitigation plan and 58.5

percent have a continuity of operations plan. Other plans included a business continuity plan, damage assessment plan, public information plan and disaster volunteer plan. Less than 50% of the respondents had one of the above plans.

All respondents reported having experienced either a local, state or federally declared disaster or a combination of the above. Only 21.4 percent developed a long term recovery plan following the disaster and 50 percent of those had a pre-disaster recovery plan in place. 23 respondents stated they have identified the necessary programs that would need to be implemented following a disaster yet only 5 of these had a pre-disaster recovery plan. One subject had a pre-disaster recovery plan in place without ever needing to create a long term post recovery plan.

Other components aiding in recovery are identifying a community's risks, vulnerabilities and critical infrastructure. 92.7 percent stated they have done a risk/vulnerability assessment and 82.9 percent have incorporated critical infrastructures into the planning process. Respondents were also asked if they had identified vulnerable populations within their community. 38.7 percent have identified low income communities, 54.8 percent identified populations with limited English proficiency, 87.1 percent have identified individuals with disabilities and 77.4 percent have identified the elderly populations. Additionally, 16.1 percent identified other vulnerable populations including, inmates and transient college populations.

For those respondents that developed a long term recovery plan, they were asked what were the major challenges that they encountered. One common theme among all respondents was creating a recovery plan that involved multiple jurisdictions and getting everyone to agree on the major issues. Other challenges included future financial implications and a lack of understanding of the process.

Respondents were also asked what were the major contributing issues encountered during recovery. The common theme was limiting the impact to the citizens. Other issues were funding and continued recovery issues years after the disaster.

Discussion

Aurora has been fortunate that it has not experienced a major disaster. There have been impacts, however from the events that have happened. Hurricane Katrina had an impact on Aurora. Temporary shelter to evacuees from Louisiana was provided. While this was not a disaster for Aurora, a presidential disaster declaration was received to assist with the recovery efforts from Louisiana. A major impact to the community was the increase in medical care needed by those affected. The emergency medical system was impacted as medically trained personnel were needed to staff the shelter operation and taken from the daily operations of the City in an attempt to not overload the 911 system. There was no direct impact on our economy, infrastructure or the environment, however it demonstrated that if the disaster was in the City of Aurora, the logistics of coordinating this level of an operation would have been greater and more difficult to manage.

The December 2006 snowstorms had a minor economic impact. The blizzards fell the week prior to Christmas. For three days the roads were either closed or impassable. Retail workers were unable to return to work and open their stores. The economic impact was minor, but overall sales for that period was reduced. In addition to the retail impact, the cost of snow removal was over one million dollars. While some of this was reimbursed by FEMA, the remaining funds depleted the snow emergency fund. March is typically the snowiest month for Aurora, and with the funds depleted, emergency

measures were put in place to ensure enough funding would be available for any additional snow events.

Two tornadoes caused damage in the last ten years. In May 1998, a tornado touched down at Aurora Airpark causing damage to a hangar, a car and a single engine airplane. Damage was estimated at 100,000. Then again in August of 2002 a tornado touched down at a condominium construction site. Four large condominiums were destroyed. Damage was estimated at six million dollars. There was one injury in the second tornado. A man in the area sought shelter in a trailer before it flipped three times. He suffered four broken ribs (NOAA, 2007). NOAA also reported six major flooding events in Aurora that caused significant street flooding resulting in numerous critical roadways to be shut down for several hours as well as many rescues of stranded motorists.

In the literature review, several authors identified the need to have communication in advance of a disaster. Decision making amongst the different organizations involved in disaster recovery, along with their unique organizational culture will affect recovery efforts (Waugh 2000). The initial recovery period will be confusing and chaotic, similar to the initial response period. Decisions will be made quickly and influence the direction of the long term recovery process. A recovery plan that identifies key recovery objectives and priorities facilitates decision making and allows for a more efficient recovery process. The planning process brings key players together in advance, saving time during the recovery process with pre-identified roles and responsibilities. Another consideration is also understanding disaster legislation from all levels of government and what the local official’s role is in dealing with the different levels of government (Schwab 1998).

This is a direct reflection of the questionnaire that was distributed. Those respondents that developed a long term recovery plan after the disaster all stated that communication among the different jurisdictions was a challenge. In addition, an understanding of the recovery process was a challenge. While legislation issues were not listed as one of the challenges, pre-disaster planning of current legislation will aid in the recovery process. Each jurisdiction has specific local guidelines as well as State and Federal guidelines to follow. Collaboration between the affected jurisdictions could identify conflicts and solutions can be addressed in advance.

Two of the most significant threats are flooding and tornados. The literature review highlighted the case study from Fort Collins and Holly Colorado. Fort Collins demonstrated that very quickly a slow moving thunderstorm can overwhelm a system. Recovery efforts remained for over one year, with the most significant long term recovery issues affecting infrastructure restoration and economic stabilization (Richardson, 1997). In the immediate days following the flood, citizens returned to their homes to find nothing left to salvage. One community was so devastated that it remains an open space park today (“Flash flood,” n.d.). Hundreds of citizens were displaced and left homeless. A disaster recovery center was established to assist residents and business with filing insurance claims and seeking federal assistance. One year after the flood, much of the city had been restored, however, there were still recovery operations underway. New mitigation projects were being evaluated and put in place to provide the best protection possible for an event of such magnitude in the future (Richardson, 1997). Flooding is Aurora’s greatest threat. While the City experiences other events more frequently, such as severe winter weather, severe flooding would cause the most damage. Considering that Aurora has not experienced a major flood, lessons learned from Fort

Collins and other municipalities can be included in the planning efforts for Aurora. While no major rivers run through Aurora, there are two major streams as well as two Class 1 dam's. Failure of a Class 1 dam would impose catastrophic damage to include fatalities to the area affected. Aurora Water's dam failure contingency plan also list the creeks in Aurora as having the potential to cause significant damage and disruption to services (City of Aurora, 2006).

Tornados are another significant natural hazard that Aurora has experienced. The DRCOG Hazard Mitigation Plan (2003) identifies the area East of Interstate 25 as being the most susceptible to tornado's. The recent Holly tornado demonstrates that not all disasters, even though they may severely impact a community, do not receive a presidential declaration. This emphasizes the point that knowing in advance what the priorities are going to be during recovery and have mechanisms in place to provide funding will facilitate the recovery process.

Three months after the tornado there was still a need for construction supplies, however an overwhelming amount of other donated items were received. This caused storage space to be filled to capacity and overflowing. A press release was issued to advise concerned citizens to please only donate cash or the needed construction related items (Mestas, 2007). This author had a similar experience when receiving the evacuees from Hurricane Katrina. An airplane hangar was used for storage of the donated items and was filled to capacity within 12 hours. The emergency operations plan discusses donations management, but does not go into detail regarding storage or long term considerations. A pre-disaster recovery plan should include this and provide options for storage and long term donation management.

A tornado of the same magnitude that affected Holly is a plausible scenario in Aurora. The area most susceptible to tornados includes a growing population with a dense grouping of structures. The largest outdoor shopping center in Colorado is located in the area susceptible to tornados. With tornados typically happening in the late afternoon, the potential for high loss of life is probable with many people visiting this shopping area during this time of day.

It is this author's interpretation that Aurora has been fortunate to have had few major events affect the citizens; however, the man made threats are increasing and the natural threats are unpredictable. In the past year Aurora has experienced two major winter storms, minor flooding during the summer months with several flash flood warnings issued in the month of July and two tornado warnings issued in June. None of these events proved significant, but the potential for any of these events to turn into a catastrophic incident is possible.

Holly, Colorado demonstrated the need to plan in advance for recovery. When developing the recovery plan, attention should be given to lines of authority, intergovernmental coordination and non-governmental integration. The Mayor of Holly was injured in the tornado and hospitalized. This required the line of authority to move to the next person in the chain of command. Several private sector businesses provided assistance in the recovery process. Through cooperation with the American Red Cross, Salvation Army, local Wal-Mart, Home Depot, and King Soopers, the immediate mass care needs were taken care of such as bringing in bottled water, food and other basic necessities. FEMA also delivered 50 trailers to assist with the housing needs for the community.

The recovery decisions faced by both of these communities were also identified as critical issues in the literature review. Those communities that are proactive in planning the recovery process will have a better understanding of the overall community needs, recovery priorities and provide a more expeditious recovery process (Schwab et al., 1998). Recovery planning, therefore, should be a deliberate process. Attention should be given to lines of authority, intergovernmental coordination and non-governmental integration (Waugh, 2000).

The implications for Aurora include bringing key players together in advance, saving time during the recovery process. Pre-identified roles and responsibilities will be considered and training to ensure that there is an understanding of these roles.

If disaster recovery planning is well organized, to include all stakeholders that have sustained interaction, Aurora's ability to communicate, adapt and implement a coordinated recovery effort is increased. Local communities can communicate their needs to their external stakeholders better in advance, increasing their ability to incorporate them into the recovery process. If this coordination is incorporated into the planning process, the recovery process is more likely to meet local needs (Petterson, 1999). The Holly tornado demonstrated a need for construction supplies. Aurora can communicate with key construction agencies in advance, identifying available resources in Aurora and the surrounding communities, to enhance the recovery efforts.

The overall goal of the recovery plan is to ensure that the citizens are safe, that economic vitality is restored (NFPA, 2007) and a more disaster resilient community is rebuilt (Schwab et al., 1998).

Recommendations

Based on this research, the City of Aurora should develop a pre-disaster recovery plan. The threats that face this community could have a catastrophic impact to the citizens. In the time it took to complete this research, Aurora and Colorado have been faced with many potential natural disasters. The City of Fort Collins experienced a 100 year flood, only 10 years after the case study listed in this research. Aurora received several flash flood watches and warnings with localized street flooding experienced during many of the storms.

In order to maintain the economic vitality, reduce social impact and restore critical lifelines in an expedient and effective manner, Aurora should identify critical recovery functions in advance. Responsibilities for each key function should be designated and planning between all key leaders should begin. Formation of a disaster recovery task force would facilitate the planning process. Membership should begin with an analysis of all stakeholders involved in recovery to include public, private, and volunteer organizations. Outreach to the private sector is a critical step in this process. Identifying what resources are located within the City of Aurora will be a major contributing factor in development of a comprehensive recovery plan.

Citizen involvement will also be vital. Aurora's diverse community will create challenges during recovery. Identifying the needs of the citizens throughout the city will increase our awareness and understanding.

Aurora currently has an emergency operations plan, comprehensive plan, snow and ice plan, and flood plain management plan. Aurora operates under the DRCOG pre-hazard mitigation plan and is in the final phases of completing a continuity of operations plan and pandemic flu plan. It is recommended that coordination among these plans take

place. Key recovery issues within each of these plans should be identified and considered in the development of a pre-disaster recovery plan to avoid conflicting efforts.

It is also recommended that a review of the recent legislation set forth in Florida, requiring all counties to develop a pre-disaster recovery plan, be reviewed and analyzed for best practices and future challenges that may arise (Boyd, Slaughter & VanKannon, 2007).

This all encompassing approach will allow Aurora to meet the short term recovery needs while balancing the long term objectives for creating a more resilient community.

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Appendix A

External Feedback Instrument for Pre-disaster recovery planning
Executive Development - Applied Research Project
(Recreated from actual SurveyMonkey.com format)

I am currently enrolled in the Executive Fire Officer Program at the National Fire Academy and am doing research on pre-disaster recovery planning. I have created a survey to assist me and would appreciate if you could please forward this email to Colorado Emergency Managers/IAEM Region 8 members. The survey can be accessed by clicking on the link located below. If you or anyone completing this survey have any questions, please feel free to contact me.

I appreciate your assistance and look forward to sharing the findings of my research with you.

1. What is the population of the community you serve?

2. Which of the following plans does your community currently have?
   a. Continuity of Operations Plan (COOP)
   b. Business Continuity Plan
   c. Emergency Operations Plan
   d. Pre-disaster Mitigation Plan
   e. Damage Assessment Plan
   f. Public Information Plan
   g. Disaster Volunteer Plan
   h. Pre-Disaster Recovery Plan
   i. Other – Please Specify

3. Has your community experienced any of the following:
   a. Locally declared disaster or emergency
   b. State declared disaster or emergency
   c. Presidential declared disaster or emergency

4. If yes, did your community develop a recovery plan following the disaster? (If NO, skip to question 7)
   a. Yes
   b. No

5. What were the major challenges in developing this plan?

6. What were the major contributing issues in your recovery

7. Has your community done a risk/vulnerability assessment?
   a. Yes
   b. No

8. Have critical infrastructures been identified and incorporated into your planning process?

a. Yes
b. No

9. Have you identified any of the following vulnerable communities that may need additional assistance during and after a disaster?
   a. Low income communities
   b. Persons with limited English proficiency
   c. Persons with disabilities
   d. Older adults
   e. Other – Please specify

10. Have you identified the necessary programs that will need to be implemented after a disaster?
   a. Yes
   b. No

Appendix B

Results from External Feedback Instrument

1. What is the population of the community you serve?	
Response Count	41

2. Which of the following plans does your community currently have?	
Response count	41
Continuity of Operations Plan (COOP)	58.5 %
Business Continuity Plan	4.9%
Emergency Operations Plan	97.6%
Pre-disaster Mitigation Plan	63.4%
Damage Assessment Plan	63.4%
Public Information Plan	48.4%
Disaster Volunteer Plan	22.0%
Pre-disaster Recovery Plan	12.2%
Other • Terrorism, Livestock,hazard mitigation plans • Community Wildfire Protection Plan • Annual Operating Plan • Infectious Disease Plan • Fire Plan • Pandemic Flu Plan • Annual Operating • Plan (wildland fire) • Continuity of Service (Flu Plan) • Man-made PDM Annex	19.5%

3. Has your community experienced any of the following:	
Response count	29
Locally declared disaster or emergency	93.1%
State declared disaster or emergency	86.2%
Presidentially declared disaster or emergency	65.5%

4. If yes, did your community develop a recovery plan following the disaster? (If NO skip to question 7)	
Response count	28
Yes	
No	

5. What were the major challenges in developing this plan?	
Response Count	7

- Resources...knowledge
- The Hayman Fire involved multiple jurisdictions and three counties. The Forest Service put together a recovery plan for this fire and continues to work on it today.
- Remapping flood plains, rebuilding, getting everyone to agree on the major issues. Future financial implications.
- Integrating military capabilities with other federal, state, and local first responders and agencies - DHS, FEMA, DOE, National Guard.
- Lack of understanding of the process.
- Different types of hazards or emergencies Involvement of all agencies and Officials
- Getting the needed participation in development

6. What were the major contributing issues in your recovery?	
Response Count	4
• Flooding after fire continues to be the major issue for recovery of this area. Each year roads are washed away and mudslides affect residents. • Changing residential areas to flood plain areas. • Getting community back to normal ASAP. Economic issues are always a factor • Funding.	

7. Has your community done a risk/vulnerability assessment?	
Response Count	41
Yes	92.7%
No	7.3%

8. Have critical infrastructures been identified and incorporated into your planning process?	
Response Count	41
Yes	82.9%
No	17.1%

9. Have you identified any of the following vulnerable communities that may need additional assistance during and after a disaster?	
Response Count	31
Low income communities	38.7%
Persons with limited English proficiency	54.8%
Persons with disabilities	87.1%
Older adults	77.4%
Other • Working on all of the above • Those dependent upon electricity for medical needs	16.1%

• Special Needs Populations • All special needs, including the jail/inmate population • College transient population • Special needs/challenged	

10. Have you identified the necessary programs that will need to be implemented after a disaster?	
Response Count	41
Yes	56.1%
No	43.9%

Population	COOP	BCP	EOP	PDMP	Damage Assessment	Public Info	Volunteer	Pre-Disaster Recovery	Local	State	Presidential	Recovery	Risk/VA	CIP	Necessary Programs
300			x	x	x								x	x	x
350			x		x	x		x					x	x	x
525			x										x	x	
1,500	x		x		x	x							x		
4,500			x	x		x			x	x	x		x	x	x
6,500			x										x		
7,000			x	x					x				x	x	
7,000			x	x									x	x	
8,000	x		x			x							x	x	
10,000	x		x	x							x		x	x	x
10,000	x		x	x					x	x			x	x	x
10,000	x												x	x	x
12.000			x												
12,000	x		x	x	x			x	x	x	x		x	x	x
14,000	x		x	x					x	x			x	x	x
14,000			x	x	x	x	x	x	x	x	x	x	x	x	x
16,000	x		x	x		x	x							x	x
17,000			x						x	x	x	x	x	x	
17,000	x		x	x		x	x						x	x	
26,000			x										x	x	x
28,000	x		x			x			x	x	x		x	x	
30,000	x	x	x		x	x	x		x	x			x	x	x
38,000	x		x										x	x	
42,000			x	x	x	x	x		x	x	x	x	x	x	x
45,000	x		x	x	x	x	x		x	x	x		x	x	x
48,000			x			x			x	x					
50,000	x		x		x	x	x		x	x	x		x	x	x
54,000			x	x					x				x		x
65,000	x		x	x					x	x			x	x	
70,000			x	x		x			x	x	x		x	x	
106,000	x		x	x	x		x		x	x			x	x	x
110,000	x		x	x	x	x			x	x	x		x	x	x
150,000	x		x	x	x				x	x	x	x	x	x	x
280,000	x		x	x		x			x	x			x	x	x
300,000	x		x	x	x				x	x	x		x	x	
414,000	x	x	x	x		x		x	x	x	x		x	x	x
415,000	x		x			x			x	x	x		x	x	
1,000,000			x						x	x	x		x		
1,000,000			x	x			x		x	x	x		x		
2,500,000	x		x	x	x	x		x	x	x	x	x	x	x	x
300,000,000	x		x	x	x	x		x		x	x	x	x	x	x

	Number	COOP	BCP	EOP	PDMP	Damage Assessment	Public Info	Volunteer	Pre-Disaster Recovery	Local	State	Presidential	Recovery	Risk/VA	CIP	Necessary Programs
Less than 100,000	30	15	1	29	16	9	14	7	3	16	14	10	3	27	25	16
Less than 1 mill	7	7	1	7	6	4	4	1	1	7	7	5	1	7	7	5
Over 1 million	4	2	0	4	3	2	2	1	2	3	4	4	2	4	2	2
Recovery Programs vs Pre-Disaster Recovery Plan									5							21
Recovery Plan vs PDRP									3				6			
Only one had a PDRP without needing a Post Recovery Plan																